EXHIBIT 6

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF OHIO

SARA HAWES, individually, and on behalf of all others similarly situated, Plaintiff, v. MACY'S WEST STORES, INC., Defendant.	Case No. 1:17-cv-00754 Judge Timothy S. Black

EXPERT REPORT OF E. LINWOOD WRIGHT, III

Background and Experience

1. My name is Linwood Wright. My experience and qualifications with respect to home furnishings and thread count are stated in the body of this report. I am being compensated on this matter at a rate of $300 per hour. The opinions in this report are my own and are based on my personal knowledge of the facts and circumstances stated herein. This report contains a complete statement of the opinions I intend to express at trial. I have not served as an expert witness in the previous 4 years.

2. I received a Bachelor of Science degree in Chemistry from Duke University in 1956; I completed The Executive Program at the Darden Graduate School of Business at the University of Virginia in 1979, and I received the Doctor of Science degree from Averett University in 2000.

3. Upon graduation from Duke in 1956, I became employed as a research chemist at Dan River Mills in Danville, Virginia. At the time that I began my employment, Dan River Mills was one of the largest textile companies in the United States. Dan River was a fully integrated

textile manufacturing operation from opening and spinning of fiber to dyeing yarn and weaving and/or knitting fabrics. These fabric products were sold in a state ready for cutting and sewing for apparel and decorative uses and in a final, consumer ready state in the case of home furnishings, specifically sheets and pillowcases in the mid-20th Century period. In later years, Dan River added comforters, bed-skirts, and decorative window hangings to its line of home furnishing products that it sold primarily to retailers. In the last decade of the twentieth century and in the early years of the twenty-first century, it converted apparel fabrics into finished shirts as a service for its existing apparel customers. This venture was primarily to take advantage of the Section 807 of the U. S. Tariff Code.

4. As a research chemist, my primary job duties were to develop organic compounds used to treat the fabrics manufactured by Dan River, primarily for wrinkle resistance and wash and wear properties and other functional properties including water repellency and flame retardancy. After approximately five years of service as a research chemist, I was promoted to Group Leader of the Finish Application Group which was responsible for commercializing products that utilized chemicals manufactured Dan River or products that were commercially offered for use in treating fabrics. Fabric finishing can best be divided into two major categories—aesthetic (fashion) appeal and functional property enhancement (e.g., wrinkle resistance). Thread count of bedding products primarily impacts aesthetic properties such as how the products feels (trade term is "hand") and how it drapes.

5. Following my work in the Research Laboratory, I was promoted to a position as the Technical Services Director for Dan River's Marketing Division in New York City, which included providing technical advice and service to Dan River's apparel and home furnishings customers. After approximately five years in that job, in 1974, I returned to the Research Division

in Danville to take a position as the Director of Research for Dan River Inc., which included the technology involved in both dyeing and finishing yarn and fabrics. Sheets and pillowcases were still the primary home furnishings products of the company at that time, and I was responsible for specifications, quality compliance, and physical testing of those products.

6. Roughly two years after becoming the Director of Research, I was also given oversight over Dan River's design department, including the design of home furnishings products (such as bedsheets). Shortly thereafter, I was made a Vice President of Dan River with responsibility for research and product development.

7. From approximately 1980 until my retirement, my work at Dan River involved direct supervision and oversight of the design and development of Dan River's home furnishings products, including bedsheets. The only further change in my job duties, prior to my retirement in 2003, was to add responsibility in the mid-80's over customer service and regulatory compliance.

8. In 2003, I retired as an employee of Dan River, but continued working as a consultant for the company until it went out of business in 2008. Since 2008, I have worked as a consultant for a variety of companies and entities, including the City of Danville.

9. Beginning in or around 1980, I became active with the American Textile

Manufacturers Institute (ATMI) as chairman of a sub-committee of the Consumer Affairs Committee dealing with bedding. Following the demise of the ATMI in or about mid-year 2003, many of these activities migrated to the National Textile Association (NTA). The NTA is a trade group of domestic fabric-forming companies and their suppliers which performs the traditional activities of a trade association: promoting the industry and its products; providing technical input for consumer information and protection; and dealing with trade issues.

10. In or around June 1, 2004, I was appointed as the chairperson of the Textile Bedding Committee of the NTA. As the committee chair, I was responsible for product related matters specifically for textile products marketed for use on beds.

11. In addition to my work with ATMI and the NTA, I served as a member of the Executive Committee on Research of the American Association of Textile Chemists and Colorists, a senior member of the American Society for Quality Control, and as an officer of that organization's Textile and Needle Trades Division. Each of these organizations and my work with them involved various specifications and compliance with those specifications of textile products.

12. An activity that I found very helpful to my own professional development was my service for many years as an adjunct faculty member of the College of Textiles Extension Department of North Carolina State University. I taught industry personnel about the importance of physical testing and compliance with specifications to ensure high levels of consumer satisfaction.

Fabric and Weaving – Basic Concepts

13. During my decades of experience with Dan River, I became intimately familiar with the manufacturing process for fabric products, including sheets. Generally, the process begins

with fibers – either staple fibers (which are very short and can be made from a variety of natural and synthetic materials) or filament fibers (which are continuous fibers, usually made either from silk or a synthetic material, such as polyester).

14. The next step in the fabric manufacturing process is to make fibers into yarns. Staple and filament fibers are made into yarns in different ways. Staple fibers, which are very short, must be spun together to create yarn. In contrast, filament fibers, which are a continuous length, are twisted together to make yarn.

15. After fibers have been made into yarn, the yarn is used to form fabric usually either woven or knitted. Weaving is accomplished on a machine called a loom. The loom is programmed or set up to weave fabric in a specific pattern. The yarn which comprises the length of the fabric product is referred to as warp yarn and the yarn that crosses over and under the warp yarns to produce the woven product is called filling yarn. The woven fabric is collected on a roll at the loom.

16. After weaving, the fabric must be thoroughly cleaned, bleached, and in the case of many home furnishing products, it is printed with a colorful pattern. The fabric can also be dyed a solid color or supplied to the consumer as a bleached white—the truly traditional appearance of a bed sheet. In Dan River's case, because of unique technology used primarily for apparel fabrics, the yarn could be dyed prior to weaving and a true plaid or stripe pattern could be offered that had superior colorfastness properties. Once the fabric is in its consumer color state, it is finished with a variety of chemical finishes. In many cases, the fabric is treated only with a softener material to make it smoother and more drapey. In more recent years, the fabrics are treated with a cross-linking agent that tends to make the product "wash and wear" or suitable for use without ironing. This kind of treatment also tends to prevent shrinkage of the cotton component of the fabric, so

size is more stable over the life of the product. Crosslinking of cotton, however, reduces the tensile strength of the yarn, and polyester is usually blended with the cotton to preserve strength. Polyester fiber is NOT deleteriously impacted by this kind of chemical treatment.

17. Once the fabric has been finished, it moves to the sewing department where it is cut into the correct product size, hemmed using a conventional sewing machine, labelled, folded, and packaged, ready for shipment to the retailer.

18. While equipment and technology changed significantly during my decades with Dan River, the basic manufacturing process described remained the same. To the best of my knowledge, it remains generally the same to this day, although there have been very limited offerings of warp knitted fabric as a bed sheet. To the best of my knowledge this kind of sheet has never met with significant market acceptance. Cutting and sewing has been automated and even folding and packaging has continued to become more automated with the passage of time.

Polyester/cotton blend sheets

19. The generic United States customs term for fabrics made with a combination of cotton and synthetic material, if they contain any quantity of more than 50% cotton, is "chief value cotton." From the time I began working with home furnishing products in the middle of the twentieth century, Dan River's business included sheets that were made with a combination of cotton and polyester. At that time, the use of polyester in bedsheets was a new concept. The primary benefit of incorporating polyester into bedsheets was that they could be finished to provide wrinkle resistance, whereas cotton sheets had NO wrinkle resistance. The addition of polyester enabled the cotton to be crosslinked while the fabric would retain adequate strength for long term consumer use. The downside was that using polyester usually made the fabric stiffer, raspier, and

less soft than fabric made only with cotton.

20. The "chief value cotton" products that were manufactured at Dan River during my time there were far different from the products at issue in this lawsuit. For one thing, at Dan River we generally spun a blend of cotton and polyester staple fibers, usually 60% cotton and 40% polyester (with the polyester fibers cut short to match the length of the cotton staple fibers and the two fiber blended prior to spinning) into a single yarn, which would generally be used as both the warp and filling yarns in the fabric. The sheets at issue in this lawsuit, by contrast, use a

combination of cotton warp yarns (spun from cotton staple fibers) and filament polyester filling yarns.

21. Dan River never considered using filament polyester yarn in bedding products, nor was it commonly used by any major, integrated textile mills during my active years in the industry. I understand the sheets at issue in this lawsuit use polyester yarn of between 15 and 25 denier per yarn with the individual filaments in the yarn being in the range of 1-2 denier per filament. This was a product that had not been introduced to the market during Dan River's years of active manufacturing, and continuous filaments yarns of that fine a denier were not commercially offered by the polyester extruders.

22. By using microdenier filament polyester yarn made from very fine filaments, it is possible to make CVC sheets that are very soft and kind to the touch with excellent no-iron properties and very good wear-life as a result of excellent strength and resistance to abrasion. These are factors which the consumer desires and enjoys.

23. I have reviewed a patent provided to me by counsel for Macy's, which is attached as Exhibit A to this report. It is my understanding that the sheets at issue in this lawsuit are woven pursuant to the process described in this and similar patents.

24. The process described in the patent—whereby several filament polyester weft yarns of between 15 and 25 denier are simultaneously inserted in a single "shed"[1] during the weaving process—is different from any process that was commercially available when I was active in the textile trade. Not only are those yarns much finer than the ones we had available, but we never inserted more than two weft yarns in a single shed. The process described by this patent is therefore

[1] A "shed" refers to the space created by the vertical separation between warp yarns through which the weft is inserted.

a significant technological advancement and the United States Patent and Trademark Office deemed it sufficiently new to issue U. S. Patent #9,131,790 B2.

25. The process described in the patent does not call for the twisting or interlacing of the polyester yarns inserted in each shed. Instead, it calls for a number of individual polyester yarns to be inserted simultaneously and in parallel. Sheets manufactured in this fashion would be superior with respect to slippage; in other words, they would not fray as easily as other sheet sets.

Past controversy over plied yarn

26. "Plied yarns" are yarns that have been spun as a single yarn, and subsequently two or more single yarns are tightly twisted together in a regular pattern to form a "plied yarn." Such twisting occurs prior to the weaving process and is usually done by whoever spins the yarn.

27. Plied yarn is twisted in a regular pattern, such that you could look at a plied yarn and determine the number of turns per inch in the plying process. There is no process of which I am aware that could cause single yarns to become regularly twisted, or plied, during the weaving process.

28. In some circumstances, yarns laid in parallel during the weaving process could become entangled, but not plied. Entanglement would occur in a random pattern at random intervals, not in a regular pattern as with plied yarn.

29. In the early 2000s, when I was the Chairman of the Textile Bedding Committee of the National Textile Association, the sheet manufacturing industry dealt with controversy with respect to determining thread count in sheets manufactured with plied yarns. Specifically, while a plied yarn had traditionally been counted as one yarn, some manufactures had begun counting each ply of a plied yarn as an individual yarn. This led to inconsistency within the industry

regarding the marketed thread count of sheets. The members of our committee were concerned that manufacturers were inflating thread counts in a manner that would cause customer confusion.

30. Because of those issues, in 2005, I wrote to the FTC to ask them to clarify how plied yarns should be counted. My letter is attached as Exhibit B to this report.

31. The FTC responded to that letter. Their response is attached as Exhibit C to this report (and was attached as Exhibit B to the Plaintiff's initial complaint in this lawsuit). In their response, the FTC confirmed that one plied yarn should be counted as one single thread, rather than counting each individual ply within a plied yarn as a thread.

Inapplicability of the FTC's 2005 letter to this Lawsuit

32. Neither my letter, nor the FTC's response, have any applicability to any type of yarn other than plied yarns, and the specific practice of counting individual plies within a plied yarn.

33. It is my understanding that the sheets at issue in this lawsuit are not made with plied yarns. As I stated above, the patent provided to me by counsel for Macy's does not describe or involve the use of twisted or plied yarns. Instead, it discloses and claims sheets manufactured with a number of polyester weft yarns simultaneously inserted in a single shed.

34. Nothing in the FTC's response to my letter means or suggests that individual, non-plied yarns should not be counted just because they are all inserted in the same shed. Instead, it is my belief (and understanding of the ASTM D3775 standard) that each individual yarn would be counted. At Dan River, I counted, reported, and claimed "double pick" (two filling yarns in one shed) as 2 yarns. These was never a question regarding the validity of this method of counting yarns.

Rebuttal to the Report of Sean Cormier

35. I have also reviewed the expert report of Sean Cormier, which was provided to me by Macy's counsel.

36. The Cormier report, which I have read, indicates that Mr. Cormier is alleging that Macy's and laboratories that tested its products were counting individual fibers as yarns. This conclusion is incorrect. If, in fact, individual fibers were being counted as yarns or threads to establish the thread count of the product, the claimed thread counts for the sheet products at issue would be in the order of magnitude of several thousand, if not more Such claimed thread counts would be erroneous and very misleading to the consumer.

37. In developing these opinions, I considered the exhibits attached to this report and the Cormier report.

Dated: May 28, 2021

Signed: E. Linwood Wright, III
E. Linwood Wright, III

EXHIBIT A

US009131790B2

(12) **United States Patent**
Agarwal

(10) **Patent No.: US 9,131,790 B2**
(45) **Date of Patent: Sep. 15, 2015**

(54) **PROLIFERATED THREAD COUNT OF A WOVEN TEXTILE BY SIMULTANEOUS INSERTION WITHIN A SINGLE PICK INSERTION EVENT OF A LOOM APPARATUS MULTIPLE ADJACENT PARALLEL YARNS DRAWN FROM A MULTI-PICK YARN PACKAGE**

(71) Applicant: **Arun Agarwal**, Dallas, TX (US)

(72) Inventor: **Arun Agarwal**, Dallas, TX (US)

(73) Assignee: **AAVN, INC.**, Dallas, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/185,942**

(22) Filed: **Feb. 21, 2014**

(65) **Prior Publication Data**

US 2015/0047736 A1 Feb. 19, 2015

Related U.S. Application Data

(60) Provisional application No. 61/866,047, filed on Aug. 15, 2013.

(51) **Int. Cl.**
D03D 1/00 (2006.01)
A47G 9/02 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A47G 9/0238*** (2013.01); ***D03D 1/00*** (2013.01); ***D03D 1/0017*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC D03D 15/00; D03D 25/00; D03D 1/00; A47G 9/02; A45F 5/00; A45F 2005/008; A45F 2005/006; A45F 2200/0575; A45F 5/02; A45F 5/004; A45F 5/021; A45F 2003/006; A45F 3/14; A63C 11/222; A45C 13/20; A45C 13/30; A45B 2009/025; A41D 19/0048; A44C 5/0007; A44C 5/0038; A44C 5/0053; A62B 35/0031; B25B 23/00; Y10S 224/904; Y10S 224/914
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,334,901	A	3/1920	Higdon
2,505,027	A	7/1946	Belsky

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2155880	A1	2/1997
CA	2346947	A1	5/2000

(Continued)

OTHER PUBLICATIONS

"Woven Fabrics and Ultraviolet Protection", University of Maribor, Faculty of Mechanical Engineering, Slovenia on Aug. 18, 2010 by Polona Dobnik Dubrovski (pp. 25) http://cdn.intechopen.com/pdfs-wm/12251.pdf.

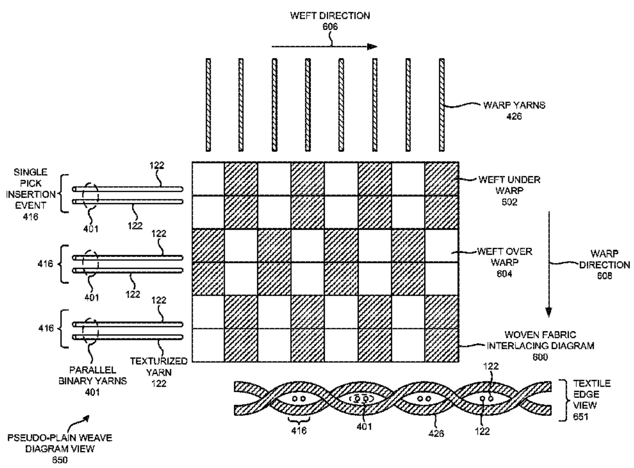
(Continued)

Primary Examiner — Bobby Muromoto, Jr.
(74) *Attorney, Agent, or Firm* — Raj Abhyanker, P.C.

(57) **ABSTRACT**

The proliferation of the thread count of a woven textile is accomplished through simultaneous insertion, within a single pick insertion event of a loom apparatus, of multiple adjacent parallel yarns drawn from a multi-pick yarn package. In one or more embodiments, multiple texturized polyester weft yarns of denier between 15 and 50 are wound on a single bobbin in a parallel adjacent fashion such that they may be fed into an air jet pick insertion apparatus of an air jet loom to weave a textile that has between 90 to 235 ends per inch cotton warp yarns and between 100 and 765 polyester weft yarns.

19 Claims, 6 Drawing Sheets



(51) **Int. Cl.**
D03D 13/00 (2006.01)
D03D 47/30 (2006.01)
D03D 23/00 (2006.01)

(52) **U.S. Cl.**
CPC ***D03D 13/004*** (2013.01); ***D03D 13/008*** (2013.01); ***D03D 47/30*** (2013.01); ***D03D 47/3046*** (2013.01); *D10B 2201/02* (2013.01); *D10B 2331/04* (2013.01); *D10B 2501/00* (2013.01); *D10B 2503/06* (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,483,861 A * 10/1949 Weiss 442/191
2,624,893 A 1/1953 Harris
2,662,234 A 12/1953 Citron
2,782,130 A 2/1957 Ness et al.
2,788,291 A 4/1957 Stertz
2,942,280 A 6/1960 May, Jr.
2,963,715 A 12/1960 Young
2,971,095 A 2/1961 Warren
3,027,573 A 4/1962 James, Jr.
3,081,197 A 3/1963 Adelman
3,144,666 A 8/1964 Clark et al.
3,265,527 A 8/1966 Adelman
3,441,063 A 4/1969 Naimer et al.
3,489,591 A 1/1970 Cardarelli
3,536,920 A 10/1970 Krol et al.
3,632,383 A * 1/1972 Dominick et al. 427/285
3,694,832 A * 10/1972 Jamison 5/497
3,721,274 A * 3/1973 Sherrill et al. 139/396
3,774,250 A 11/1973 Miller
3,828,544 A * 8/1974 Alker 57/210
4,042,986 A 8/1977 Goodman et al.
4,191,221 A * 3/1980 Boyer .... 139/426 R
4,196,355 A 4/1980 Maine
4,279,045 A 7/1981 Vitale
4,338,693 A 7/1982 Vitale
4,352,380 A * 10/1982 Owen et al. .... 139/426 R
4,422,195 A 12/1983 Russo et al.
4,429,094 A 1/1984 Massucco
4,485,838 A 12/1984 Shoji et al.
4,496,619 A 1/1985 Okamoto
4,534,819 A 8/1985 Payet
4,546,493 A 10/1985 Bortnick
4,578,306 A * 3/1986 Heiman 442/214
4,621,489 A * 11/1986 Okada 57/210
4,634,625 A * 1/1987 Franklin 442/196
4,651,370 A 3/1987 Vitale
4,662,013 A 5/1987 Harrison
4,670,326 A * 6/1987 Heiman 442/214
4,672,702 A 6/1987 Isham
4,682,379 A 7/1987 Dugan
4,703,530 A 11/1987 Gusman
4,724,183 A * 2/1988 Heiman 442/214
4,727,608 A 3/1988 Joyce
4,734,947 A 4/1988 Vitale
4,742,788 A 5/1988 Dugan
4,777,677 A 10/1988 Dugan
4,802,251 A 2/1989 O'Dell
4,825,489 A 5/1989 Ross
4,839,934 A 6/1989 Rojas
4,861,651 A 8/1989 Goldenhersh
4,896,406 A * 1/1990 Weingarten et al. 28/166
4,903,361 A 2/1990 Tang
4,912,790 A 4/1990 MacDonald
4,962,546 A 10/1990 Vitale
4,962,554 A 10/1990 Tesch
4,980,564 A 12/1990 Steelmon et al.
4,980,941 A 1/1991 Johnson, III
4,985,953 A 1/1991 Seago et al.
5,010,610 A 4/1991 Ackley
5,010,723 A * 4/1991 Wilen 57/210
5,020,177 A 6/1991 Etherington
5,029,353 A 7/1991 Kimball et al.
5,046,207 A 9/1991 Chamberlain
5,056,441 A 10/1991 Seago et al.
5,070,915 A 12/1991 Kalin
5,092,006 A 3/1992 Fogel
5,103,504 A 4/1992 Dordevic
5,161,271 A 11/1992 Gronbach
5,191,777 A 3/1993 Schnegg
5,217,796 A 6/1993 Kasai et al.
5,249,322 A 10/1993 Seago
5,275,861 A 1/1994 Vaughn
5,285,542 A 2/1994 West et al.
5,287,574 A 2/1994 Kardell et al.
5,325,555 A 7/1994 Whitley
5,364,683 A * 11/1994 Flint et al. 428/141
5,414,913 A 5/1995 Hughes
5,465,760 A 11/1995 Mohamed et al.
5,487,936 A * 1/1996 Collier 442/214
5,488,746 A 2/1996 Hudson
5,495,874 A * 3/1996 Heiman .... 139/420 A
5,530,979 A 7/1996 Whitley
5,531,985 A 7/1996 Mitchell et al.
5,542,137 A 8/1996 Byfield
5,625,912 A 5/1997 McCain et al.
5,628,062 A 5/1997 Tseng
5,635,252 A 6/1997 Fraser, Jr. et al.
5,642,547 A 7/1997 Hutton et al.
5,729,847 A 3/1998 Allardice
5,765,241 A 6/1998 MacDonald
5,809,593 A 9/1998 Edwards
5,869,193 A 2/1999 Langley
5,884,349 A 3/1999 Gretsinger
5,906,004 A 5/1999 Lebby et al.
5,932,494 A 8/1999 Crippa
5,968,854 A 10/1999 Akopian et al.
5,985,773 A 11/1999 Lee
5,996,148 A 12/1999 McCain et al.
6,025,284 A 2/2000 Marco et al.
6,034,003 A 3/2000 Lee
6,037,280 A 3/2000 Edwards et al.
6,098,219 A 8/2000 Milber
6,148,871 A 11/2000 Hassell et al.
6,164,092 A 12/2000 Menaker
6,243,896 B1 6/2001 Osuna et al.
6,281,515 B1 8/2001 Demeo et al.
6,338,367 B1 1/2002 Khokar
6,353,947 B1 3/2002 McCain et al.
6,369,399 B1 4/2002 Smirnov
6,499,157 B1 12/2002 McCain et al.
6,610,395 B2 8/2003 Rohrbach et al.
6,823,544 B2 11/2004 Treece
6,934,985 B2 8/2005 Sanders
7,032,262 B2 4/2006 Creech
7,140,053 B1 11/2006 Mangano
7,143,790 B2 12/2006 Liao
7,181,790 B2 2/2007 Wirtz
7,325,263 B2 2/2008 Stribling
7,398,570 B2 7/2008 Seago
7,476,889 B2 1/2009 Demeo et al.
7,673,656 B2 * 3/2010 Heiman 139/391
7,726,348 B2 * 6/2010 Heiman .... 139/383 R
7,856,684 B2 12/2010 Robertson et al.
8,053,379 B2 11/2011 Tingle et al.
8,171,581 B2 5/2012 Agarwall
8,186,390 B2 * 5/2012 Krishnaswamy et al. 139/420 A
8,230,537 B2 * 7/2012 Stewart et al. 5/501
8,267,126 B2 9/2012 Rabin et al.
8,334,524 B2 12/2012 Demeo et al.
8,566,983 B2 10/2013 Monaco
8,624,212 B2 1/2014 Yang et al.
8,627,521 B2 1/2014 Rowson et al.
8,640,282 B2 2/2014 Maguire et al.
8,689,375 B2 4/2014 Stinchcomb
8,690,964 B2 4/2014 Kramer et al.
8,707,482 B1 4/2014 Ramthun
8,911,833 B2 12/2014 Medoff
2002/0088054 A1 7/2002 McCain et al.
2002/0174945 A1 11/2002 Fair
2003/0092339 A1 5/2003 Covelli
2003/0190853 A1 10/2003 Lovingood

(56) **References Cited**

U.S. PATENT DOCUMENTS

2003/0194938	A1*	10/2003	Efird et al.	442/334
2004/0031098	A1	2/2004	Hollander	
2004/0040090	A1	3/2004	Wootten	
2004/0055660	A1*	3/2004	Heiman	139/420 R
2004/0067706	A1	4/2004	Woods	
2005/0039937	A1	2/2005	Yeh et al.	
2005/0042960	A1	2/2005	Yeh et al.	
2005/0070192	A1	3/2005	Lorenzotti et al.	
2005/0095939	A1	5/2005	Heiman	
2005/0109418	A1	5/2005	Liao	
2006/0180229	A1*	8/2006	Heiman	139/420 R
2007/0014967	A1*	1/2007	Tingle et al.	428/96
2007/0202763	A1	8/2007	Shibaoka et al.	
2008/0057813	A1*	3/2008	Tingle et al.	442/203
2008/0096001	A1*	4/2008	Emden et al.	428/222
2008/0124533	A1	5/2008	Bouckaert et al.	
2009/0155601	A1	6/2009	Lavature et al.	
2009/0260707	A1	10/2009	Aneja et al.	
2010/0015874	A1*	1/2010	Tingle et al.	442/187
2010/0107339	A1	5/2010	Stinchcomb	
2012/0009405	A1*	1/2012	Krishnaswamy et al.	428/219
2012/0047624	A1	3/2012	Hubsmith	
2012/0157904	A1	6/2012	Stein	
2012/0186687	A1	7/2012	Huffstickler et al.	
2014/0109315	A1	4/2014	Lilienthal	
2014/0123362	A1	5/2014	Seitz et al.	
2014/0157575	A1	6/2014	Stinchcomb	
2014/0166909	A1	6/2014	Onizawa	
2014/0304922	A1	10/2014	Kramer et al.	
2014/0310858	A1	10/2014	Kupiec	
2014/0342970	A1	11/2014	Kramer et al.	
2015/0026893	A1	1/2015	Garrett et al.	

FOREIGN PATENT DOCUMENTS

CN	1361315	A	7/2002
CN	101385091	A	3/2009
CN	202072865	U	12/2011
CN	203475074	U	3/2014
CN	103820902	A	5/2014
EP	0758692	A1	2/1997
EP	0913518	A1	5/1999
EP	1389645	A2	2/2004
EP	1678358	A1	7/2006
EP	1400616	B1	2/2007
WO	02059407	A1	8/2002
WO	2005045111	A1	5/2005
WO	2006062495	A1	6/2006
WO	2006069007	A2	6/2006
WO	2007133177	A2	11/2007
WO	2008042082	A2	4/2008
WO	2009115622	A1	9/2009

OTHER PUBLICATIONS

"Electromagnetic Shielding Fabrics", LessEMF.com website on Jul. 8, 2015 (pp. 19) http://www.lessemf.com/fabric.html.

"Ultraviolet (UV) Protection of Textiles: A Review", International Scientific Conference, Gabrovo on Nov. 19-20, 2010 by Mine Akgun et al. (pp. 11) http://www.singipedia.com/attachment.php?attachmentid=1907&d=1296035072.

"Textiles in Electromagnetic Radiation Protection", Journal of Safety Engineering, p-ISSN: 2325-0003 in 2013 by Subhankar Maity et al. (pp. 9) http://www.sapub.org/global/showpaperpdf.aspx?doi=10.5923/j.safety.20130202.01.

"UV Protection Textile Materials", AUTEX Research Journal, vol. 7, No. 1 in Mar. 2007 by D. Saravanan (pp. 10) http://www.autexrj.com/cms/zalaczone_pliki/6-07-1.pdf.

* cited by examiner

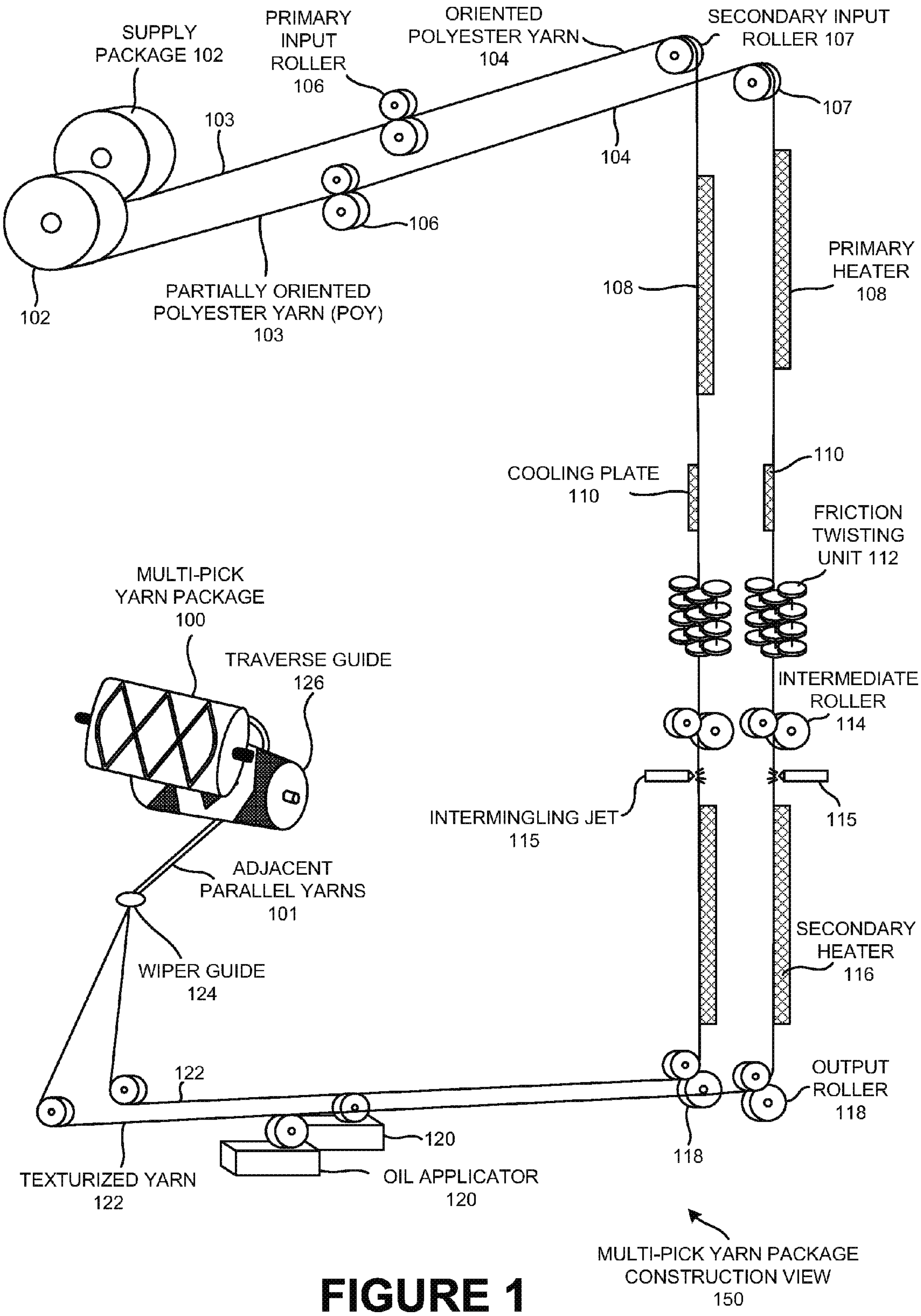

SUPPLY PACKAGE 102
PRIMARY INPUT ROLLER 106
ORIENTED POLYESTER YARN 104
SECONDARY INPUT ROLLER 107
103
107
104
106
102
PARTIALLY ORIENTED POLYESTER YARN (POY) 103
108
PRIMARY HEATER 108
110
COOLING PLATE 110
FRICTION TWISTING UNIT 112
MULTI-PICK YARN PACKAGE 100
TRAVERSE GUIDE 126
INTERMEDIATE ROLLER 114
INTERMINGLING JET 115
115
ADJACENT PARALLEL YARNS 101
WIPER GUIDE 124
SECONDARY HEATER 116
122
OUTPUT ROLLER 118
120
118
TEXTURIZED YARN 122
OIL APPLICATOR 120
MULTI-PICK YARN PACKAGE CONSTRUCTION VIEW 150

FIGURE 1

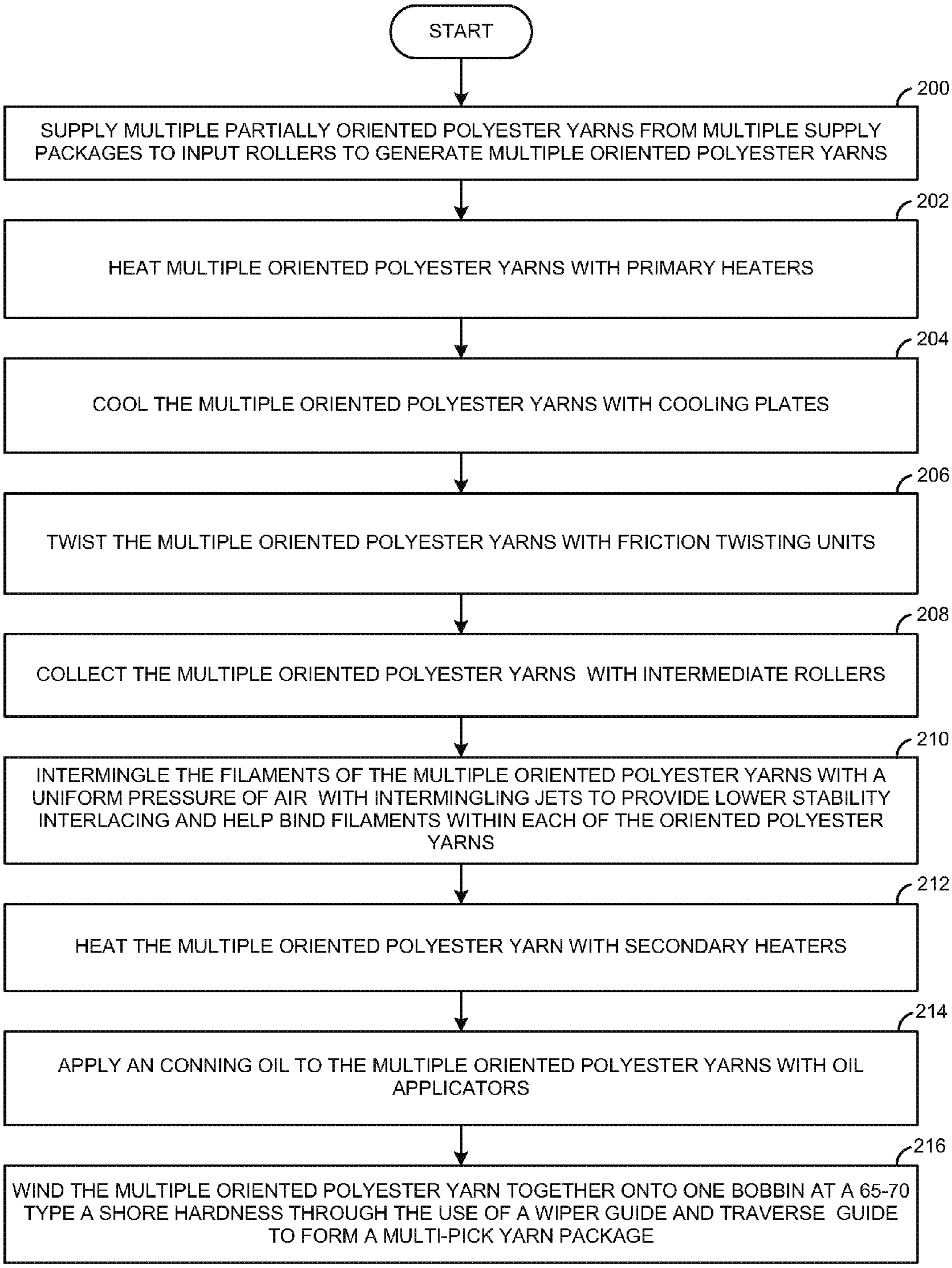

START
200
SUPPLY MULTIPLE PARTIALLY ORIENTED POLYESTER YARNS FROM MULTIPLE SUPPLY PACKAGES TO INPUT ROLLERS TO GENERATE MULTIPLE ORIENTED POLYESTER YARNS
202
HEAT MULTIPLE ORIENTED POLYESTER YARNS WITH PRIMARY HEATERS
204
COOL THE MULTIPLE ORIENTED POLYESTER YARNS WITH COOLING PLATES
206
TWIST THE MULTIPLE ORIENTED POLYESTER YARNS WITH FRICTION TWISTING UNITS
208
COLLECT THE MULTIPLE ORIENTED POLYESTER YARNS WITH INTERMEDIATE ROLLERS
210
INTERMINGLE THE FILAMENTS OF THE MULTIPLE ORIENTED POLYESTER YARNS WITH A UNIFORM PRESSURE OF AIR WITH INTERMINGLING JETS TO PROVIDE LOWER STABILITY INTERLACING AND HELP BIND FILAMENTS WITHIN EACH OF THE ORIENTED POLYESTER YARNS
212
HEAT THE MULTIPLE ORIENTED POLYESTER YARN WITH SECONDARY HEATERS
214
APPLY AN CONNING OIL TO THE MULTIPLE ORIENTED POLYESTER YARNS WITH OIL APPLICATORS
216
WIND THE MULTIPLE ORIENTED POLYESTER YARN TOGETHER ONTO ONE BOBBIN AT A 65-70 TYPE A SHORE HARDNESS THROUGH THE USE OF A WIPER GUIDE AND TRAVERSE GUIDE TO FORM A MULTI-PICK YARN PACKAGE

FIGURE 2

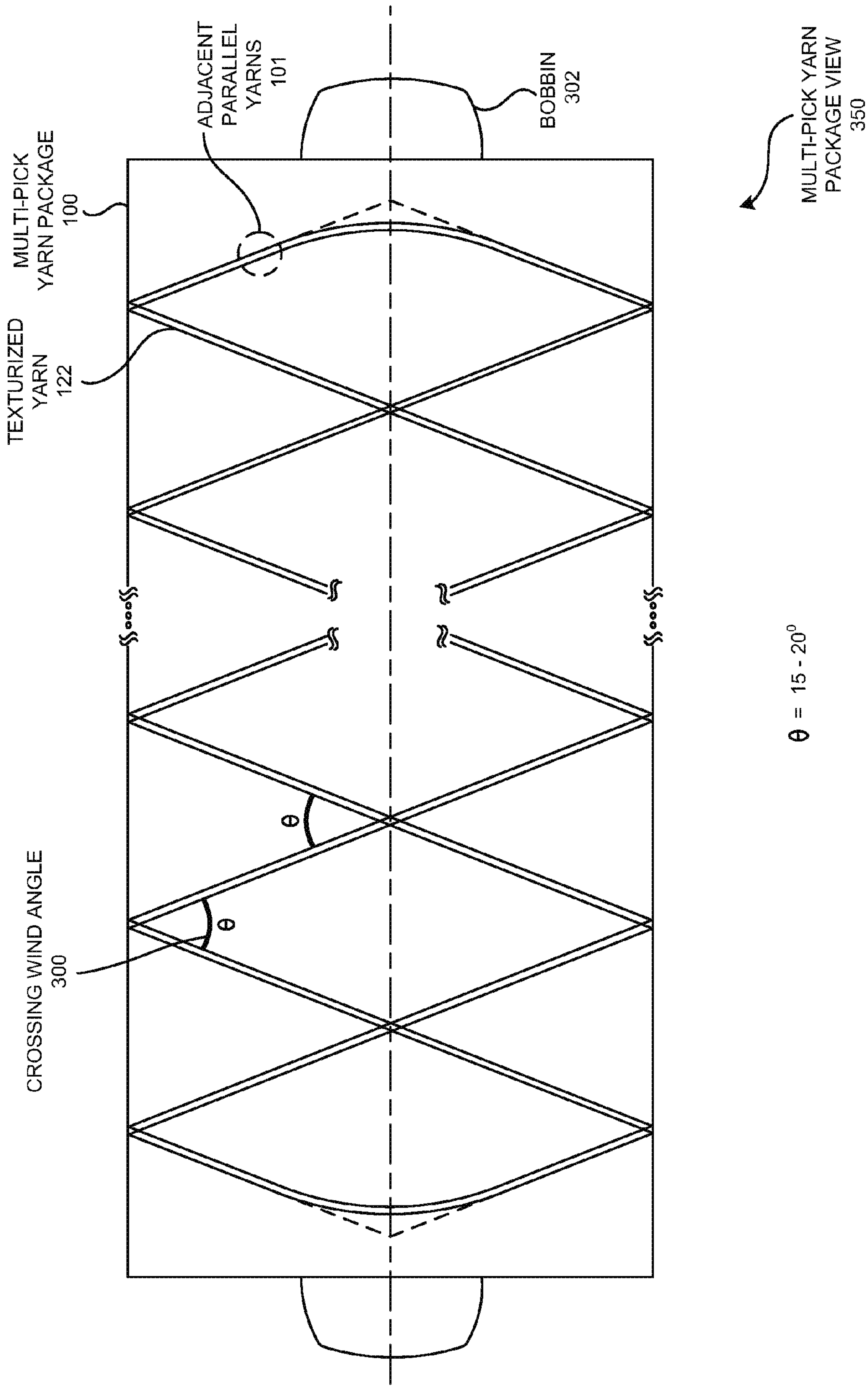

MULTI-PICK YARN PACKAGE 100
ADJACENT PARALLEL YARNS 101
BOBBIN 302
MULTI-PICK YARN PACKAGE VIEW 350
TEXTURIZED YARN 122
CROSSING WIND ANGLE 300
θ
θ
θ = 15 - 20°

FIGURE 3

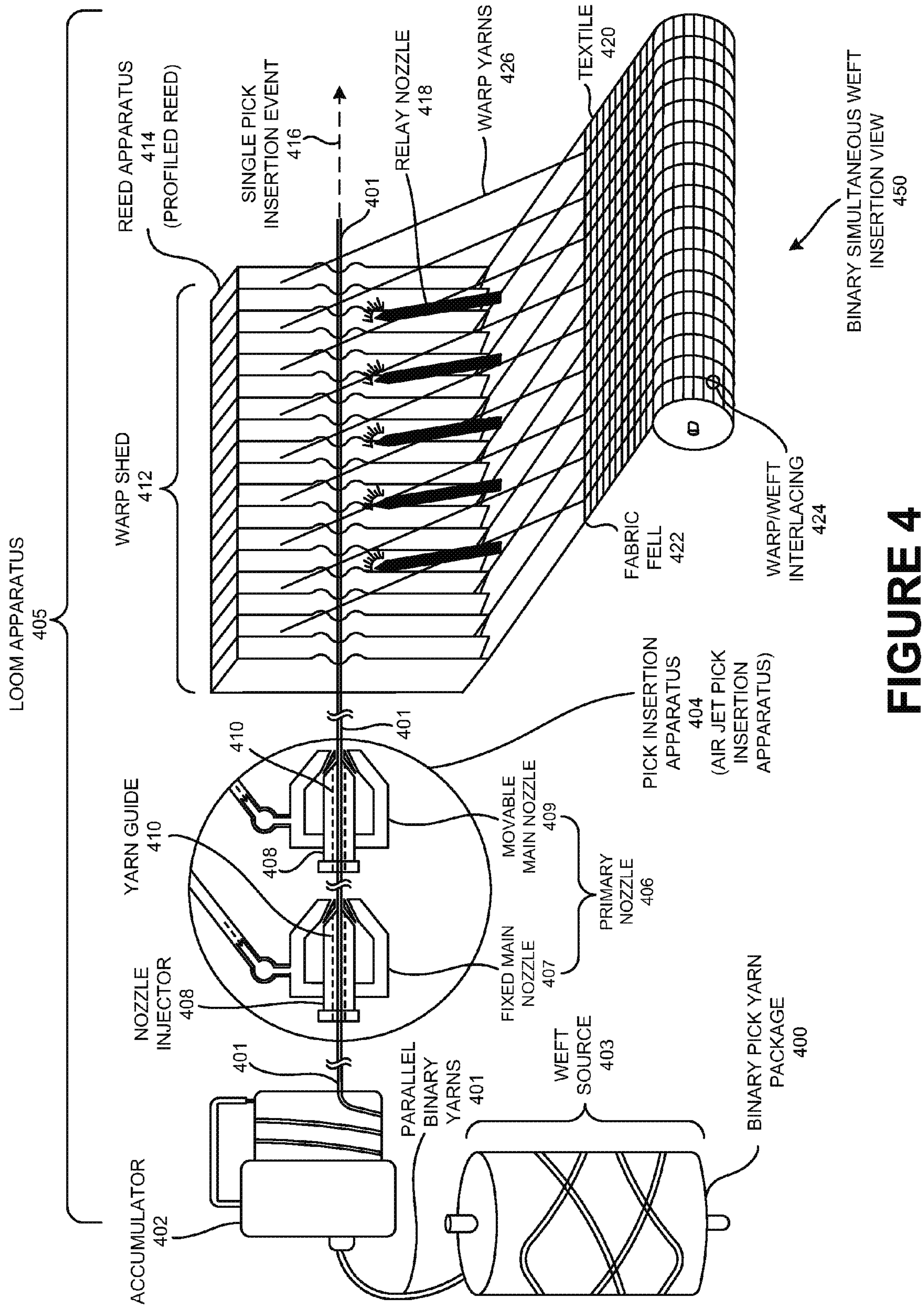

LOOM APPARATUS
405
ACCUMULATOR
402
NOZZLE INJECTOR
408
YARN GUIDE
410
WARP SHED
412
REED APPARATUS
414
(PROFILED REED)
SINGLE PICK INSERTION EVENT
416
401
RELAY NOZZLE
418
WARP YARNS
426
TEXTILE
420
BINARY SIMULTANEOUS WEFT INSERTION VIEW
450
FABRIC FELL
422
WARP/WEFT INTERLACING
424
PICK INSERTION APPARATUS
404
(AIR JET PICK INSERTION APPARATUS)
401
410
408
MOVABLE MAIN NOZZLE
409
PRIMARY NOZZLE
406
FIXED MAIN NOZZLE
407
401
PARALLEL BINARY YARNS
401
WEFT SOURCE
403
BINARY PICK YARN PACKAGE
400

FIGURE 4

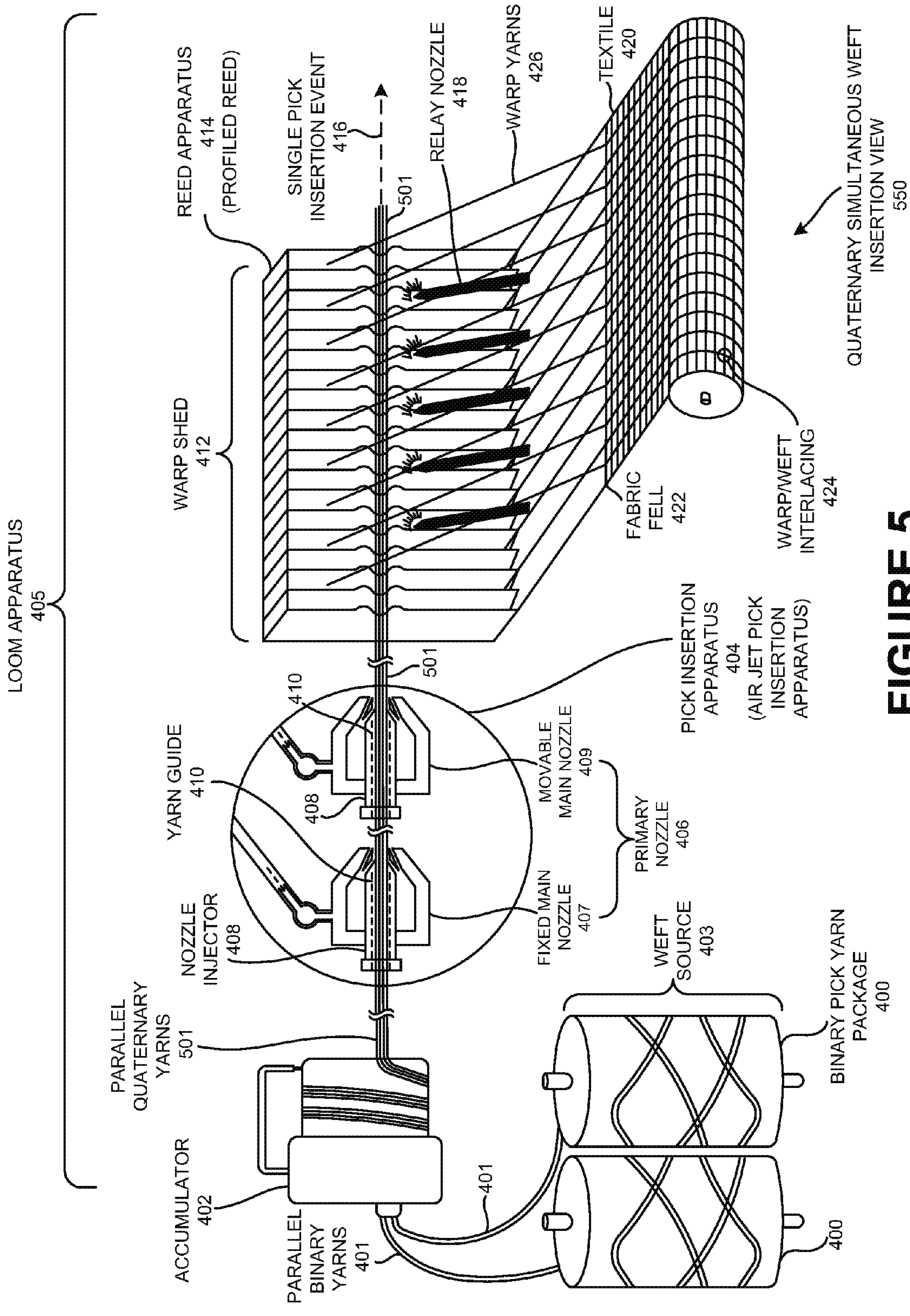

LOOM APPARATUS
405
REED APPARATUS
414
(PROFILED REED)
SINGLE PICK
INSERTION EVENT
416
501
RELAY NOZZLE
418
WARP YARNS
426
TEXTILE
420
WARP SHED
412
FABRIC
FELL
422
WARP/WEFT
INTERLACING
424
QUATERNARY SIMULTANEOUS WEFT
INSERTION VIEW
550
PICK INSERTION
APPARATUS
404
(AIR JET PICK
INSERTION
APPARATUS)
410
YARN GUIDE
410
408
MOVABLE
MAIN NOZZLE
409
PRIMARY
NOZZLE
406
FIXED MAIN
NOZZLE
407
NOZZLE
INJECTOR
408
WEFT
SOURCE
403
PARALLEL
QUATERNARY
YARNS
501
BINARY PICK YARN
PACKAGE
400
ACCUMULATOR
402
401
PARALLEL
BINARY
YARNS
401
400

FIGURE 5

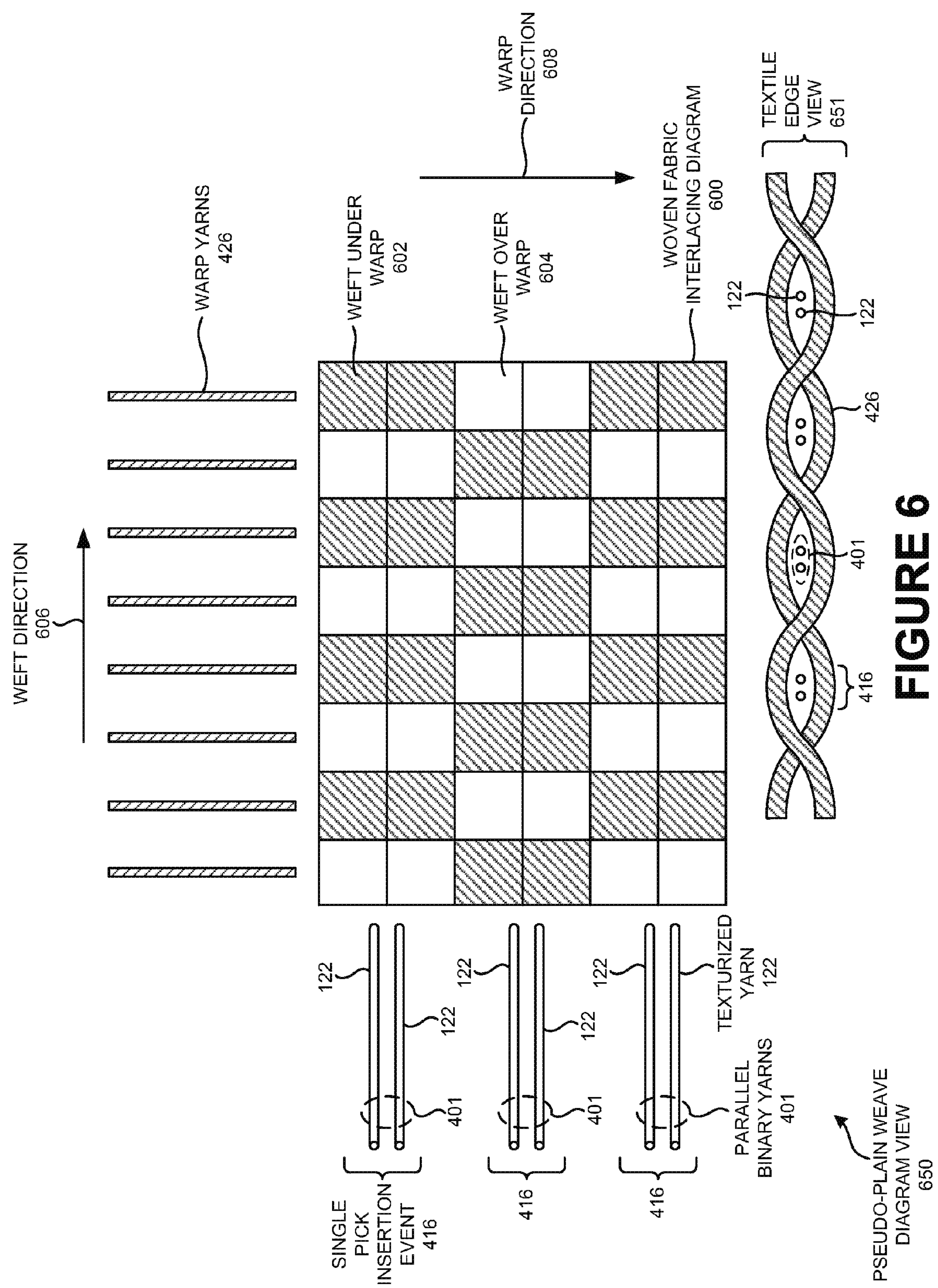

WEFT DIRECTION 606
WARP YARNS 426
WEFT UNDER WARP 602
WEFT OVER WARP 604
WARP DIRECTION 608
WOVEN FABRIC INTERLACING DIAGRAM 600
TEXTILE EDGE VIEW 651
122
122
426
401
416
SINGLE PICK INSERTION EVENT 416
416
416
122
122
122
122
122
401
401
TEXTURIZED YARN 122
PARALLEL BINARY YARNS 401
PSEUDO-PLAIN WEAVE DIAGRAM VIEW 650

FIGURE 6

PROLIFERATED THREAD COUNT OF A WOVEN TEXTILE BY SIMULTANEOUS INSERTION WITHIN A SINGLE PICK INSERTION EVENT OF A LOOM APPARATUS MULTIPLE ADJACENT PARALLEL YARNS DRAWN FROM A MULTI-PICK YARN PACKAGE

CLAIMS OF PRIORITY

This patent application claims priority from, and hereby incorporates by reference and claims priority from the entirety of the disclosures of the following cases and each of the cases on which they depend and further claim priority or incorporate by reference: U.S. Provisional patent application No. 61/866,047, titled 'IMPROVED PROCESS FOR MAKING TEXTURIZED YARN AND FABRIC FROM POLYESTER AND COMPOSITION THEREOF' filed on Aug. 15, 2013.

FIELD OF TECHNOLOGY

This disclosure relates generally to textiles and, more particularly, to a method, a device and/or a system of a proliferated thread count of a woven textile by simultaneous insertion within a single pick insertion event of a loom apparatus multiple adjacent parallel yarns drawn from a multi-pick yarn package.

BACKGROUND

A consumer textile, for example apparel or bed sheets, may possess several characteristics that make it desirable. One desirable characteristic may be comfort for fabrics that come in contact with human skin. Another desirable characteristic may be durability, as consumer textiles may be laundered in machine washers and dryers that may tend to shorten the useful lifespan of the textile. In commercial operations, machine laundering may occur more than in residential or small-scale settings, which may further shorten the lifespan of the textile.

For textiles that contact human skin (for example T-shirts, underwear, bed sheets, towels, pillowcases), one method to increase comfort may be to use cotton yarns. Cotton may have high absorbency and breathability. Cotton may also generally be known to have a good "feel" to consumers.

But cotton may not be robust when placed in an environment with heavy machine laundering. To increase durability while retaining the feel and absorbency of cotton, the cotton yarns may be woven in combination with synthetic fibers such as polyester. Cotton may be used as warp yarns, while synthetic yarns may be used as weft yarns.

Constructing the textile using yarns with a smaller denier may also increase comfort. Using these relatively fine yarns may yield a higher "thread count." A thread count of a textile may be calculated by counting the total weft yarns and warp yarns in along two adjacent edges of a square of fabric that is one-inch by one-inch. The thread count may be a commonly recognized indication of the quality of the textile, and the thread count may also be a measure that consumers associate with tactile satisfaction and opulence.

However, fine synthetic weft yarns, such as polyester, may break when fed into a loom apparatus. Cotton-polyester hybrid weaves may therefore be limited to larger denier synthetic yarns that the loom may effectively use. Thus, the thread count, and its associated comfort and luxury, may be limited.

In an attempt to claim high thread counts, some textile manufacturers may twist two yarns together, such that they may be substantially associated, before using them as a single yarn in a weaving process. A twisted yarn may yield properties in the textile similar to the use of a large denier yarn. Manufactures of textiles with twisted yarns may include within the advertised "thread count" each strand within each twisted yarn, even though the textile may not feel of satisfactory quality once it has been removed from its packaging and handled by the consumer. The Federal Trade Commission has taken the position in an opinion letter that it considers the practice of including each yarn within a twisted yarn in the thread count as deceptive to consumers.

Because fine denier yarns may break in a loom apparatus, cotton-synthetic blends may be limited to low thread counts and thus relatively low quality and comfort.

SUMMARY

Disclosed are a method, a device and/or a system of proliferated thread count of a proliferated thread count of a woven textile by simultaneous insertion within a single pick insertion event of a loom apparatus multiple adjacent parallel yarns drawn from a multi-pick yarn package.

In one embodiment, a woven textile fabric includes from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns. The warp yarns may be made of a cotton material, and may have a total thread count is from 300 to 1000. The woven textile fabric may be made of multi-filament polyester yarns having a denier of 20 to 65. The woven textile fabric may have multi-filament polyester yarns having a denier of 15 to 35. The woven textile fabric may also have multi-filament polyester yarns have a denier of 20 to 25.

Additionally, the multi-filament polyester yarns may contain 10 to 30 filaments each. The woven textile fabric may have a minimum tensile strength in a warp direction of 17 kilograms to 65 kilograms and a minimum tensile strength in a weft direction of 11.5 kilograms to 100 kilograms. The woven textile fabric may have a warp-to-fill ratio that is between 1:2 to 1:4.

In another aspect, a method of weaving a fabric includes drawing multiple polyester weft yarns from a weft source to a pick insertion apparatus of a loom apparatus. The method also includes conveying by the pick insertion apparatus the multiple polyester weft yarns across a warp shed of the loom apparatus through a set of warp yarns in a single pick insertion event of the pick insertion apparatus of the loom apparatus and beating the multiple polyester weft yarns into a fell of the fabric with a reed apparatus of the loom apparatus such that the set of warp yarns and/or the multiple polyester weft yarns become interlaced into a woven textile fabric. The method forms the woven textile having from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns.

The denier of the polyester weft yarns may be between 15 and 50. The weft source may be a weft yarn package in which the multiple polyester weft yarns are wound substantially parallel to one another and substantially adjacent to one another to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Further, the number of the multiple polyester weft yarns wound substantially parallel to one another and substantially adjacent to one another on the weft yarn package may be two. The number of the multiple polyester weft yarns conveyed by the pick insertion apparatus across the warp shed of the loom appara-

tus through the set of warp yarns in the single pick insertion event of the pick insertion apparatus of the loom apparatus may be between two and eight.

Additionally, the pick insertion apparatus of the loom apparatus may be an air jet pick insertion apparatus. The multiple polyester weft yarns may be wound on the yarn package at an angle of between 15 and/or 20 degrees to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Additionally, the multiple polyester weft yarns may be wound on the yarn package at a type A shore hardness of between 65 to 70 to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Further, the multiple polyester weft yarns may be treated with a conning oil comprising a petroleum hydrocarbon, an emulsifier and/or a surfactant to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. The pick insertion apparatus of the loom apparatus may be a rapier insertion apparatus and/or a bullet insertion apparatus.

An airflow of a primary nozzle and/or a fixed nozzle of an air jet pick insertion apparatus pick insertion apparatus may be adjusted to between 12 Nm^3/hr to 14 Nm^3/hr to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. The airflow of each relay nozzle in the air jet pick insertion apparatus pick insertion apparatus may be adjusted to between 100 and/or 140 millibars to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. A drive time of a drive time of a relay valve of the air jet pick insertion apparatus pick insertion apparatus may be adjusted to between 90 degrees and/or 135 degrees to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and the multiple polyester weft yarns may have a denier of 22.5 with 14 filaments.

The multiple polyester weft yarns may be treated with a primary heater heated to approximately 180 degrees Celsius to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and the multiple polyester weft yarn may be treated with a cooling plate at a temperature of between 0 and 25 degrees Celsius subsequent to the treating with the primary heater.

In yet another aspect, a bedding material having the combination of the "feel" and absorption characteristics of cotton and the durability characteristics of polyester with multi-filament polyester weft yarns having a denier of between 15 and 50 and cotton warp yarns woven in a loom apparatus that simultaneously inserts multiple of the multi-filament polyester weft yarns during a single pick insertion event of the loom apparatus in a parallel fashion such that each of the multiple polyester weft yarns maintain a physical adjacency between each other during the single pick insertion event, increasing the thread count of a woven fabric of the bedding material based on the usage of multi-filament polyester weft yarns with a denier between 15 and 50. The bedding is a woven textile fabric that includes from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns.

The total thread count of the bedding material may be from 300 to 1000 and each multi-filament polyester yarn count of the bedding material may have from 10 to 30 filaments each.

The methods and systems disclosed herein may be implemented in any means for achieving various aspects, and may be executed in a form of a non-transitory machine-readable medium embodying a set of instructions that, when executed by a machine, cause the machine to perform any of the operations disclosed herein. Other features will be apparent from the accompanying drawings and from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments of this invention are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

FIG. **1** is a multi-pick yarn package construction view in which two discrete partially-oriented polyester yarns are oriented, texturized, convened to convened to parallel adjacency by a wiper guide, and then wound onto a single multi-pick yarn package, according to one or more embodiments.

FIG. **2** is a process diagram showing the procedure by which the partially-oriented polyester yarn may be oriented, texturized and wound on a spindle to form the multi-pick yarn package of FIG. **1**, according to one or more embodiments.

FIG. **3** is a multi-pick yarn package view showing the parallel configuration of the adjacent texturized yarns and their crossing wind angle within the multi-pick yarn package, imposed by the wiper guide and traverse guide of FIG. **1**, respectively, according to one or more embodiments.

FIG. **4** is a binary simultaneous weft insertion view of an exemplarily use of the multi-pick yarn package of FIG. **3** in which two adjacent parallel yarns forming a binary pick yarn package are fed into an air jet loom apparatus such that a primary nozzle simultaneously propels two picks across a warp shed of the loom apparatus in a single pick insertion event, according to one or more embodiments.

FIG. **5** is a quaternary simultaneous weft insertion view of an exemplarily use of more than one of the multi-pick yarn package of FIG. **3** in which two of the binary pick yarn packages of FIG. **4** are fed into an air jet loom apparatus such that a primary nozzle simultaneously propels four picks across a warp shed of the loom apparatus in a single pick insertion event, according to one or more embodiments.

FIG. **6** is a pseudo-plain weave diagram view and textile edge view that demonstrates the resulting 1×2 weave when the adjacent parallel yarn pair from the binary pick yarn package of FIG. **4** is conveyed across the warp shed of a loom apparatus configured to interlace warp and weft yarns after a single pick insertion event, according to one or more embodiments.

Other features of the present embodiments will be apparent from the accompanying drawings and from the detailed description that follows.

DETAILED DESCRIPTION

Disclosed are a method, a device and a system of a proliferated thread count of a woven textile by simultaneous insertion within a single pick insertion event of a loom apparatus multiple adjacent parallel yarns drawn from a multi-pick yarn package. Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments.

FIG. **1** is a multi-pick yarn package construction view in which two discrete partially-oriented polyester yarns are ori-

ented, texturized, convened to convened to parallel adjacency by a wiper guide, and then wound onto a single multi-pick yarn package, according to one or more embodiments. Particularly, FIG. **1** illustrates a multi-pick yarn package **100**, an adjacent parallel yarns **101**, a supply package **102**, a partially oriented polyester yarn (POY) **103**, an oriented polyester yarn **104**, an primary input roller **106**, a secondary input roller **107**, a primary heater **108**, a cooling plate **110**, a friction twisting unit **112**, an intermediate roller **114**, a secondary heater **116**, an output roller **118**, an oil applicator **120**, a texturized yarn **122**, a wiper guide **124**, and a traverse guide **126**.

In the embodiment of FIG. **1**, the multi-pick yarn package **100** may be formed from two of the partially oriented polyester yarns **103** (POY) that may be oriented and texturized by a number of elements set forth in FIG. **1**. The multi-pick yarn package **100** may be used to supply weft yarns (weft yarns may also be known as "fill," "picks," "woof" and/or "filling yarns") in any type of loom apparatus, including those with pick insertion mechanisms such as rapier, bullet, magnetic levitation bullet, water jet and/or air jet. In one preferred embodiment, and as described in conjunction with the description of FIG. **4** and FIG. **5**, the loom may use an air jet pick insertion mechanism. The partially oriented polyester yarn **103** may be comprised of one or more extruded filaments of polyester.

The primary input roller **106** may draw the partially oriented polyester yarn **103** from the supply package **102**. The secondary input roller **107**, which may operate at a higher speed than the primary input roller **106**, may then draw the partially oriented polyester yarn **103** from the primary input roller **106**, forming the oriented polyester yarn **104**. In a preferred embodiment, the secondary input roller **107** rotates at 1.7 times the speed of the primary input roller **106**.

The oriented polyester yarn **104** may then be drawn through the primary heater **108**. The primary heaters may be heated to a temperature between 50° C. and 200° C. In one preferred embodiment, the primary heater may be set to 190° C. After leaving the heater, the oriented polyester yarn **104** may then be exposed to the cooling plate **110** that may be set at a temperature between 0° C. and room temperature (e.g., about 20-25° C.). The cooling plate may also be set at temperatures between 25° C. and 40° C., and in one preferred embodiment 38° C.

The intermediate roller **114** may draw the oriented polyester yarn **104** from the cooling plate **110** to the friction twisting unit **112**. The friction twisting unit **112** (e.g., an FTU) may twist/detwist the filaments within the oriented polyester yarn **104** such that it gains a texture (e.g., such that the resulting textile the oriented polyester yarn **104** may be woven into gains in "body" or heft) and may also provide a low stability interlacing in the weaving process. The friction twisting unit **112** may also help to intermingle the polyester filaments that may comprise the oriented polyester yarn **104**. The twist imparted by the friction twisting unit **112** may be translated through the oriented polyester yarn **104** back to the primary heater **108**, which, in conjunction with the cooling plate **110**, may "fix" the molecular structure of the twisted filaments of the oriented polyester yarn **104**, imbuing it with a "memory" of torsion.

The intermediate roller **114** may convey the oriented polyester yarn **104** to the intermingling jet **115** that may apply a uniform air pressure to the oriented polyester yarn **104** to provide counter-twist to the friction twisting unit **112**. The oriented polyester yarn **104** may then be heated by the secondary heater **116**. The secondary heater **116** may be set to between 50° C. and 200° C. In one preferred embodiment, the intermingling jet **115** may be set to a pressure of 2 bars and the secondary heater **116** may be set to a temperature of 170° C.

The output roller **118** may convey the oriented polyester yarn **104** to the oil applicator **120**. The oil applicator **120** may apply conning oil. The conning oil applied by the oil applicator **120** may act as a lubricant, reducing a friction between two or more yarns (e.g., several of the oriented polyester yarns **104**) and between one or more yarns and a loom apparatus (e.g., metallic components the oriented polyester yarn **104** may contact). The conning oil may also minimize a static charge formation of synthetic yarns. The conning oil may be comprised of a mineral oil (e.g., a petroleum hydrocarbon), a moisture, an emulsifier (e.g., a non ionic surfactant, a fatty alcohol an ethoxylatlate, and/or a fatty acid), and/or a surfactant. In addition, as will be shown and described in conjunction with the description of FIG. **4**, the conning oil may help prevent a dissociation of the adjacent parallel yarns **101** when the adjacent parallel yarns **101** are propelled across a warp shed **408** during a single pick insertion event **416** of a loom apparatus **405**. The rate at which the oil applicator **120** applies the conning oil may be adjusted to a minimum amount required to prevent dissociation of the adjacent parallel yarns **101** during a pick insertion event (e.g., the single pick insertion event **416** of FIG. **4**), depending on the type of loom apparatus employed.

After conning oil may be applied by the oil applicator **120**, the oriented polyester yarn **104** may be the texturized yarn **122** ready to be wound on a yarn supply package spindle (e.g., to become the multi-pick yarn package **100**).

The wiper guide **124** may collect and convene multiple of the texturized yarns **122** such that the texturized yarns **122** become the adjacent parallel yarns **101**. The adjacent parallel yarns **101** may then enter the traverse guide **126**, which may wind the adjacent parallel yarns **101** onto a spool to form the multi-pick yarn package **100**. The traverse guide **126** may wind the multi-pick yarn package **100** at a crossing wind angle of between 15-20° (e.g., the crossing wind angle **300** of FIG. **3**, denoted θ), and at a type A shore hardness of between 65 and 70. In one preferred embodiment, the number of texturized yarns **122** that may be convened by the wiper guide **124** to be would onto the multi-pick yarn package **100** may be two (e.g., the binary pick yarn package **400** of FIG. **4**).

In one preferred embodiment, the partially oriented polyester yarn **103** may have a denier of 22.5 with 14 polyester filaments. In another preferred embodiment, the partially oriented polyester yarn **103** may have a denier of between 15 and 25. One skilled in the art will know that denier may be a unit of measure for a linear mass density of a fiber, such measure defined as the mass in grams per 9000 meters of the fiber. The wiper guide **124** may substantially unite the texturized yarn **122** into the adjacent parallel yarns **101** such that, if considered a unitary yarn, the adjacent parallel yarns **101** may have 28 filaments and a denier of about 45. In contrast, if two of the partially oriented polyester yarns **103** with 14 filaments and a denier of 22.5 are twisted around one another, the twisted yarns, if considered a unitary yarn, may have a denier higher than 45 due to increased linear mass density of twisted fibers within a given distance. Yarns twisted in this fashion may also not qualify as independent yarns for calculating thread count according to industry standards of regulatory bodies.

FIG. **2** is a process diagram showing the procedure by which the partially-oriented polyester yarn may be oriented, texturized and wound on a spindle to form the multi-pick yarn package of FIG. **1**, according to one or more embodiments. In operation **200**, multiple partially oriented polyester yarns (e.g., the partially oriented polyester yarns **103**) may be supplied to input rollers to yield oriented yarn (e.g., the oriented

polyester yarn **104**). In operation **202**, multiple oriented yarns are heated by two primary heaters. In operation **204**, the multiple oriented polyester yarns may be cooled by cooling plates. In operation **206**, the multiple oriented polyester yarns may be twisted, individually, by friction twisting units. In operation **208**, the oriented polyester yarns may be collected by intermediate rollers. In operation **210**, the filaments of the oriented polyester yarns may be intermingled, individually, by a uniform pressure of air by intermingling jets to provide lower stability interlacing and help bind the filaments within each individual partially oriented polyester yarn **104**.

In operation **212**, the multiple of the oriented polyester yarns may be heated by secondary heaters, and in operation **214**, the oriented polyester yarns may have conning oil applied to each yarn by oil applicators. In operation **216**, the oriented polyester yarns (which may now be the texturized yarns **122**), may be wound onto a single spindle at 65-70 type A shore hardness through the use of a wiper guide and traverse guide to form the multi-pick yarn package **100**.

FIG. **3** is a multi-pick yarn package view **350** showing the parallel configuration of the adjacent texturized yarns and their crossing wind angle within the multi-pick yarn package, imposed by the wiper guide and traverse guide of FIG. **1**, respectively, according to one or more embodiments. Particularly, FIG. **3** further illustrates a crossing wind angle **300** (denoted θ), and a bobbin **302**.

In the embodiment of FIG. **3**, the multi-pick yarn package **100** is shown wound with the adjacent parallel yarns **101** comprising two of the texturized yarns **122**. The adjacent parallel yarns **101** may be wound on a bobbin **302**. The bobbin may also be a strait or a tapered bobbin. The crossing wind angle **300** may be the acute angle formed at the intersection between the adjacent parallel yarns **101** deposited in a first pass of the traverse guide **126** and the adjacent parallel yarns **101** in a subsequent pass of the traverse guide **126**, as shown in FIG. **3**.

FIG. **4** is a binary simultaneous weft insertion view **450** of an exemplarily use of the multi-pick yarn package of FIG. **3** in which two adjacent parallel yarns forming a binary pick yarn package are fed into an air jet loom apparatus such that a primary nozzle simultaneously propels two picks across a warp shed of the loom apparatus in a single pick insertion event, according to one or more embodiments. Particularly, FIG. **4** further illustrates a binary pick yarn package **400** (e.g., the multi-pick yarn package **100** wound with two of the texturized yarns **122**), a parallel binary yarns **401**, an accumulator **402**, a weft source **403** a cross section of a pick insertion apparatus **404** (e.g., an air jet pick insertion apparatus), a primary nozzle **406** comprised of a fixed main nozzle **407** and a moveable main nozzle **409**, a nozzle injector **408**, a yarn guide **410**, a warp shed **412**, a reed apparatus **414** (e.g., a profiled reed of the air jet loom), a single pick insertion event **416**, a relay nozzle **418**, a textile **420**, a fabric fell **422**, and a warp/weft interlacing **424**.

The loom apparatus **405** (e.g., a rapier loom, a bullet loom, an air jet loom) may accept a weft source **403** supplying the adjacent parallel yarns **101**. In the embodiment of FIG. **4**, the loom apparatus **405** may be an air jet loom apparatus (e.g., a Picanol Omni Plus®, a Picanol Omni Plus® 800) and the weft source **403** may be the binary pick yarn package **400**, which is the multi-pick yarn package **100** wound with two of the adjacent parallel yarns **101** in accordance with the process of FIG. **1** and FIG. **2**. The two of the adjacent parallel yarns **101** drawn from the binary pick yarn package **400** and fed into the loom apparatus **405** may be referred to as the parallel binary yarns **401**.

The parallel binary yarns **401** may be fed into the air jet loom apparatus and the elements thereof in accordance with ordinary practice to one skilled in the art. FIG. **4** illustrates some of the elements of an air jet loom apparatus that may interact with the parallel binary yarns **401** such as the accumulator **402**, the primary nozzle **406**, the fixed main nozzle **407**, the moveable main nozzle **409**, the profiled reed (e.g., the reed apparatus **414** of the air jet loom) and the relay nozzles **418**.

For example, the parallel binary yarns **401** from the binary pick yarn package **400** may be fed into an accumulator **402** of the air jet pick insertion apparatus. The accumulator **402** may be designed to collect and hold in reserve between each of the single pick insertion events **416** a length of the parallel binary yarns **401** needed to cross the warp shed **412** with a minimal unwinding resistance. Next, the parallel binary yarns **401** may pass into the pick insertion apparatus **404** (in the embodiment of FIG. **4**, a cross section of an air jet pick insertion apparatus is shown). The primary nozzle **406** may be comprised of one or more individual nozzles. In the embodiment of FIG. **4**, the primary nozzle **406** is comprised of the fixed main nozzle **407** and the moveable main nozzle **409**. The primary nozzle **406** may accept the adjacent parallel yarns **101** through a yarn guide **410** of a nozzle injector **408** that may be present in both the fixed main nozzle **407** and the moveable main nozzle **409**. In an alternate embodiment, the primary nozzle **406** may be comprised of a single nozzle.

Air entering the fixed main nozzle **407** and/or the moveable main nozzle **409** may drive back the nozzle injector **408** and propel the parallel binary yarns **401** across the warp shed **412** of the loom apparatus **405**. The airflow of the primary nozzle may be adjusted to between 12 Nm^3/hour to 14 Nm^3/hour. The airflow of the fixed main nozzle **407** may be adjusted to between 12 Nm^3/hour to 14 Nm^3/hour and a drive time of the relay valves (not shown in the embodiment of FIG. **4**) may be adjusted to between 90° and 135°.

The parallel binary yarns **401** may enter the warp shed **412** of the loom apparatus **405**. With the air jet pick insertion apparatus of FIG. **4**, the parallel binary yarns **401** may be aided in crossing the warp shed **412** by a plurality of relay nozzles **418** associated with a reed apparatus **414** that, to aid in gaseous conveyance of the picks, may be a profiled reed. Each of the relay nozzles **418** may be adjusted to between 100 mbar to 14 mbar.

The parallel binary yarns **401** drawn from the multi-pick yarn package may cross the warp shed **412** in the single pick insertion event **416**. The single pick insertion event **416** is the operation and/or process of the pick insertion apparatus **404** that is known in the art to be ordinarily associated with the projection of yarns (or yarns comprised of multiple yarns twisted together) across the warp shed **412**. For example, the yarn threaded through the yarn guide **410** of the primary nozzle **406** may be a single yarn that yarn may be projected across the warp shed **412** of the loom apparatus **405** in a single burst (or rapid timed succession of bursts) of pressurized air from a single of the primary nozzles **406**. In another example, the single pick insertion event **416** may be one cycle of a rapier arm (e.g., a rapier pick insertion apparatus) through the warp shed **412**.

Upon crossing the warp shed **412** of the loom apparatus **405**, the reed apparatus **414** may "beat up" (e.g., perform a beat up motion) the parallel binary yarns **401**, forcing them into the fabric fell **422** (also known as "the fell of the cloth") of the textile **420** that the loom apparatus **405** may be producing. The beat up motion of the reed apparatus **414** may form the warp/weft interlacing **424** of the warp yarns **426** and the

parallel binary yarns **401** (e.g., the weft yarns), producing an incremental length of the textile **420**.

FIG. **5** is a quaternary simultaneous weft insertion view **550** of an exemplarily use of more than one of the multi-pick yarn package of FIG. **3** in which two of the binary pick yarn packages of FIG. **4** are fed into an air jet loom apparatus such that a primary nozzle simultaneously propels four picks across a warp shed of the loom apparatus in a single pick insertion event, according to one or more embodiments. Particularly, FIG. **5** further illustrates the use of a parallel quaternary yarns **501**.

In FIG. **5**, the weft source **403** may be two of the binary pick yarn packages **400** of FIG. **4**, each supplying two of the parallel binary yarns **401** (e.g., four of the texturized yarns **122**), that may be fed into the pick insertion apparatus **404** of the loom apparatus **405** (in the embodiment of FIG. **5**, the air jet loom) such that the two parallel binary yarns **401** may become the parallel quaternary yarn **501**. Therefore, four of the texturized yarns **122** may be threaded through the yarn guide **410** of the primary nozzle **406**, and all four of the texturized yarns **122** may be projected across the warp shed **412** in a single burst of pressurized air from the primary nozzle **406**. To further illustrate, the four of the texturized yarns **122** (e.g., the parallel quaternary yarns **501**) shown in FIG. **5** may be substantially adjacent and parallel as opposed to twisted around one another.

In an alternate embodiment not shown in FIG. **4** or FIG. **5**, the weft source **403** of the loom apparatus **405** may be three or more of the multi-pick yarn packages **100**. For example, the weft source **403** may be four binary pick yarn packages **400**. In such a case, eight of the texturized yarns **122** may be projected across the warp shed **412** during the single pick insertion event **416**. In one embodiment, the highest thread counts (e.g., 800, 1000) may be yielded by using four of the binary pick yarn packages **400** as the weft source **403**.

In yet another embodiment not shown in FIG. **4** or FIG. **5**, there may also be an odd number of the texturized yarns **122** (e.g., a tertiary parallel yarns) propelled across the warp shed **412** in the single pick insertion event **416**, for example of the weft source **403** was composed of a the single-pick yarn package along with one of the binary pick yarn packages **400** of FIG. **4**. The tertiary parallel yarns may also result where the multi pick yarn package **100** is wound with three of the texturized yarns **122** by the process of FIG. **1** and FIG. **2**. In addition, the deniers of the texturized yarns **122** wound on the multi-pick yarn package **100** may be heterogeneous.

It will be recognized to one skilled in the art that the loom apparatus **405** may have tandem, multiple, or redundancies of the pick insertion apparatuses **404** which may insert yarns in an equal number of the single pick insertion events **416**. For example, an air jet loom apparatus may have multiple of the primary nozzles **406** (e.g., four, eight). A number of the primary nozzles **406** may each insert the adjacent parallel yarns **101** in a corresponding number of the single pick insertion events **416** before the reed apparatus **414** beats the adjacent parallel yarns **101** into the fabric fell **422**. For example, an air jet loom utilizing six of the primary nozzles **406**, with each of the primary nozzles **406** supplied by one of the binary pick yarn packages **400**, may project six the parallel binary yarns **401** across the warp shed **412** in six of the single pick insertion events **416** that are distinct. In such an example, twelve of the texturized yarns **122** would be beat into the fabric fell **422** during the beat up motion of the reed apparatus **414**. In one embodiment, the highest thread counts (e.g., 800, 1000) may be yielded by using multiple of the pick insertion apparatuses **404** (e.g., four, each projecting two of the adjacent parallel

yarns **101** across the warp shed **412** before the reed apparatus **414** carries out the beat-up motion).

FIG. **6** is a pseudo-plain weave diagram view **650** and textile edge view **651** that demonstrates the resulting 1×2 weave when the adjacent parallel yarn pair from the binary pick yarn package of FIG. **4** is conveyed across the warp shed of a loom apparatus configured to interlace warp and weft yarns after a single pick insertion event, according to one or more embodiments. Particularly, FIG. **6** further illustrates a woven fabric interlacing diagram **600** having sections with a weft under warp **602**, a weft over warp **604**, a weft direction **606**, and a warp direction **608**.

FIG. **6** shows the woven fabric interlacing diagram **600** that may result when a loom apparatus (e.g., the loom apparatus **405**) is configured to interlace the warp yarns **426** and the adjacent parallel yarns **101** drawn from the binary pick yarn package **400** of FIG. **4** after a single pick insertion event **416**. Because two of the texturized yarns **122** may be wound on the binary pick yarn package **400**, the resulting woven fabric interlacing may be a "1 by 2" weave with the weft under warp **602** and weft over warp **604** alternating after each of the warp yarns **426** in the weft direction **606** and alternating after each two of the texturized yarns **122** in the warp direction **608**. For example, while the loom apparatus may be traditionally configured to produce a textile with a plain wave (e.g., having a woven fabric interlacing diagram **600** of alternating weft under warp **602** and weft over warp **604** in both the weft direction **606** and the warp direction **608**, similar to chess board), the result will be a the 1 by 2 "pseudo-plain weave" woven fabric interlacing diagram **600** of FIG. **6**.

The warp yarns **426** of a textile produced using the multi-pick yarn package **100** (e.g., the textile **420**) may be comprised of natural or synthetic fibers, and the weft yarns may be polyester weft yarns (e.g., the adjacent parallel yarns **101** comprised of multiple of the texturized yarns **122**). In one preferred embodiment, the warp yarns may be made of cotton.

The textile produced from the multi-pick yarn package **100** may have between 90 and 235 warp yarn ends per inch, between 100 and 765 picks per inch, and may have a warp-to-fill ratio between 1:2 and 1:4 (in other words, 1 warp yarn per every 4 weft yarns). The textile produced using the multi-pick yarn package **100** may have a thread count of between 200 to 1000, a minimum tensile strength of 17.0 kg to 65.0 kg (about 37.5 lbs to 143.5 lbs) in the warp direction **608**, and a minimum tensile strength of 11.5 kg to 100.0 kg (about 25.4 lbs to 220.7 lbs) in the weft direction **606**. In one or more embodiments the textile manufactured using the multi-pick yarn package **100** may have a composition of 45-49% texturized polyester yarn (e.g., the texturized yarn **122**) and 51-65% cotton yarn.

The partially oriented polyester yarn **103** (that becomes the texturized yarn **122** after undergoing operations **200** through **216** of FIG. **2**) may have multiple filaments and may have a denier of between 15 and 50. In one preferred embodiment, the partially oriented polyester yarn **103** may have about a denier of about 20 and have about 14 filaments.

The resulting fabric produced may be of exceptionally high quality compared to prior-art cotton-synthetic hybrid weaves due to its high thread count. To further increase quality and comfort of the textile, the fabric may be finished by brushing the surface to increase softness (a process known as "peaching" or "peach finishing"). In addition, various other finishing methods may be used in association with the textile produced from the multi-pick yarn package **100** to increase the resulting textile's quality.

In one embodiment, a woven textile fabric includes from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns. The warp yarns may be made of a cotton material, and may have a total thread count is from 300 to 1000. The woven textile fabric may be made of multi-filament polyester yarns having a denier of 20 to 65. The woven textile fabric may have multi-filament polyester yarns having a denier of 15 to 35. The woven textile fabric may also have multi-filament polyester yarns have a denier of 20 to 25.

Additionally, the multi-filament polyester yarns may contain 10 to 30 filaments each. The woven textile fabric may have a minimum tensile strength in a warp direction of 17 kilograms to 65 kilograms and a minimum tensile strength in a weft direction of 11.5 kilograms to 100 kilograms. The woven textile fabric may have a warp-to-fill ratio that is between 1:2 to 1:4.

In another aspect, a method of weaving a fabric includes drawing multiple polyester weft yarns from a weft source to a pick insertion apparatus of a loom apparatus. The method also includes conveying by the pick insertion apparatus the multiple polyester weft yarns across a warp shed of the loom apparatus through a set of warp yarns in a single pick insertion event of the pick insertion apparatus of the loom apparatus and beating the multiple polyester weft yarns into a fell of the fabric with a reed apparatus of the loom apparatus such that the set of warp yarns and/or the multiple polyester weft yarns become interlaced into a woven textile fabric. The method forms the woven textile having from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns.

The denier of the polyester weft yarns may be between 15 and 50. The weft source may be a weft yarn package in which the multiple polyester weft yarns are wound substantially parallel to one another and substantially adjacent to one another to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Further, the number of the multiple polyester weft yarns wound substantially parallel to one another and substantially adjacent to one another on the weft yarn package may be two. The number of the multiple polyester weft yarns conveyed by the pick insertion apparatus across the warp shed of the loom apparatus through the set of warp yarns in the single pick insertion event of the pick insertion apparatus of the loom apparatus may be between two and eight.

Additionally, the pick insertion apparatus of the loom apparatus may be an air jet pick insertion apparatus. The multiple polyester weft yarns may be wound on the yarn package at an angle of between 15 and/or 20 degrees to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Additionally, the multiple polyester weft yarns may be wound on the yarn package at a type A shore hardness of between 65 to 70 to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. Further, the multiple polyester weft yarns may be treated with a conning oil comprising a petroleum hydrocarbon, an emulsifier and/or a surfactant to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. The pick insertion apparatus of the loom apparatus may be a rapier insertion apparatus and/or a bullet insertion apparatus.

An airflow of a primary nozzle and/or a fixed nozzle of the air jet pick insertion apparatus pick insertion apparatus may

be adjusted to between 12 Nm^3/hr to 14 Nm^3/hr to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. The airflow of each relay nozzle in the air jet pick insertion apparatus pick insertion apparatus may be adjusted to between 100 and/or 140 millibars to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus. A drive time of a drive time of a relay valve of the air jet pick insertion apparatus pick insertion apparatus may be adjusted to between 90 degrees and/or 135 degrees to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and the multiple polyester weft yarns may have a denier of 22.5 with 14 filaments.

The multiple polyester weft yarns may be treated with a primary heater heated to approximately 180 degrees Celsius to enable the simultaneous inserting of the multiple polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and the multiple polyester weft yarn may be treated with a cooling plate at a temperature of between 0 and 25 degrees Celsius subsequent to the treating with the primary heater.

In yet another aspect, a bedding material having the combination of the "feel" and absorption characteristics of cotton and the durability characteristics of polyester with multi-filament polyester weft yarns having a denier of between 15 and 50 and cotton warp yarns woven in a loom apparatus that simultaneously inserts multiple of the multi-filament polyester weft yarns during a single pick insertion event of the loom apparatus in a parallel fashion such that each of the multiple polyester weft yarns maintain a physical adjacency between each other during the single pick insertion event, increasing the thread count of a woven fabric of the bedding material based on the usage of multi-filament polyester weft yarns with a denier between 15 and 50. The bedding is a woven textile fabric that includes from 90 to 235 ends per inch warp yarns and from 100 to 765 picks per inch multi-filament polyester weft yarns.

The total thread count of the bedding material may be from 300 to 1000 and each multi-filament polyester yarn count of the bedding material may have from 10 to 30 filaments each.

Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments. In addition, the process flows depicted in the figures do not require the particular order shown, or sequential order, to achieve desirable results. In addition, other operations may be provided, or operations may be eliminated, from the described flows, and other components may be added to, or removed from, the described systems. Accordingly, other embodiments are within the scope of the following claims.

What is claimed is:

1. A woven textile fabric comprising:

from 90 to 235 ends per inch warp yarns; and

from 100 to 765 picks per inch multi-filament polyester weft yarns;

wherein the picks are woven into the textile fabric in groups of at least two multi-filament polyester weft yarns running parallel to each other,

wherein the multi-filament polyester weft yarns are wound substantially parallel to one another and substantially adjacent to one another on a multi-pick yarn package to enable the simultaneous inserting of the multi-filament

polyester weft yarns during a single pick insertion event of a pick insertion apparatus of a loom apparatus,

wherein the number of the multi-filament polyester weft yarns wound substantially parallel to one another and substantially adjacent to one another on the weft yarn package is two,

wherein the number of the multi-filament polyester weft yarns conveyed by the pick insertion apparatus across a warp shed of the loom apparatus through a set of warp yarns in the single pick insertion event of the pick insertion apparatus of the loom apparatus is between two and eight,

wherein the pick insertion apparatus of the loom apparatus is an air jet pick insertion apparatus,

wherein the multi-filament polyester weft yarns are wound on the multi-pick yarn package at an angle of between 15 and 20 degrees to enable the simultaneous inserting of the multi-filament polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and

wherein the multi-filament polyester weft yarns are wound on the multi-pick yarn package at a type a shore hardness of between 65 to 70 to enable the simultaneous inserting of the multi-filament polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus.

2. The woven textile fabric of claim **1**:

wherein the warp yarns are made of a cotton material.

3. The woven textile fabric of claim **2**:

wherein a total thread count is from 300 to 1000.

4. The woven textile fabric of claim **1**:

wherein the multi-filament polyester yarns have a denier of 20 to 65.

5. The woven textile fabric of claim **1**:

wherein the multi-filament polyester yarns have a denier of 15 to 35.

6. The woven textile fabric of claim **2**:

wherein the multi-filament polyester yarns have a denier of 20 to 25.

7. The woven textile fabric of claim **6**:

wherein the multi-filament polyester yarns contain 10 to 30 filaments each.

8. The woven textile fabric of claim **7**:

wherein the fabric has a minimum tensile strength in a warp direction of 17 kilograms to 65 kilograms,

wherein the fabric has a minimum tensile strength in a weft direction of 11.5 kilograms to 100 kilograms, and

wherein the fabric has a warp-to-fill ratio is between 1:2 to 1:4.

9. The woven textile fabric of claim **1**:

wherein weft yarns within each group run parallel to each other in a plane which substantially includes the warp yarns.

10. The woven textile fabric of claim **1**:

wherein each of the groups is made up of four multi-filament polyester weft yarns.

11. A woven textile fabric comprising:

from 90 to 235 ends per inch warp yarns; and

from 100 to 765 picks per inch multi-filament polyester weft yarns;

wherein the picks are woven into the textile fabric in groups of two multi-filament polyester weft yarns running parallel to each other,

wherein the multi-filament polyester weft yarns are wound substantially parallel to one another and substantially adjacent to one another on a multi-pick yarn package to enable the simultaneous inserting of the multi-filament polyester weft yarns during a single pick insertion event of a pick insertion apparatus of a loom apparatus,

wherein the number of the multi-filament polyester weft yarns wound substantially parallel to one another and substantially adjacent to one another on the weft yarn package is two,

wherein the number of the multi-filament polyester weft yarns conveyed by the pick insertion apparatus across a warp shed of the loom apparatus through a set of warp yarns in the single pick insertion event of the pick insertion apparatus of the loom apparatus is two,

wherein the multi-filament polyester weft yarns are wound on the multi-pick yarn package at an angle of between 15 and 20 degrees to enable the simultaneous inserting of the multi-filament polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus, and

wherein the multi-filament polyester weft yarns are wound on the multi-pick yarn package at a type a shore hardness of between 65 to 70 to enable the simultaneous inserting of the multi-filament polyester weft yarns during the single pick insertion event of the pick insertion apparatus of the loom apparatus.

12. The woven textile fabric of claim **11**:

wherein the warp yarns are made of a cotton material.

13. The woven textile fabric of claim **12**:

wherein a total thread count is from 300 to 1000.

14. The woven textile fabric of claim **11**:

wherein the multi-filament polyester yarns have a denier of 20 to 65.

15. The woven textile fabric of claim **11**:

wherein the multi-filament polyester yarns have a denier of 15 to 35.

16. The woven textile fabric of claim **12**:

wherein the multi-filament polyester yarns have a denier of 20 to 25.

17. The woven textile fabric of claim **16**:

wherein the multi-filament polyester yarns contain 10 to 30 filaments each.

18. The woven textile fabric of claim **17**:

wherein the fabric has a minimum tensile strength in a warp direction of 17 kilograms to 65 kilograms,

wherein the fabric has a minimum tensile strength in a weft direction of 11.5 kilograms to 100 kilograms, and

wherein the fabric has a warp-to-fill ratio is between 1:2 to 1:4.

19. The woven textile fabric of claim **11**:

wherein weft yarns within each group run parallel to each other in a plane which substantially includes the warp yarns.

* * * * *

EXHIBIT B

Case 4:18-cv-02671-YGR Document 94-10 Filed 12/04/18 Page 5 of 8

National Textile Association

6 Beacon Street • Suite 1125 • Boston, Massachusetts 02108
617 542-8220 • info@nationaltextile.org • www.nationaltextile.org • 617 542-2199 fax

ORIGINAL

May 23, 2005
By FAX 202-326-2496

FEDERAL TRADE COMMISSION
RECEIVED DOCUMENTS
218296
JUN 5 2005
517516
SECRETARY

Mr. Donald S. Clark, Secretary
U.S. Federal Trade Commission
600 Pennsylvania Avenue, N.W.
Washington, D.C. 20580

Re: Request for Staff Opinion

Dear Mr. Secretary:

Pursuant to 16. C.F.R. Section 1, the National Textile Association ("NTA") requests a staff opinion from the Federal Trade Commission (the "Commission") regarding the method for determining thread count in textile bedding products. The NTA is the largest trade association representing the U.S. Textile Industry and its suppliers, and consists of about 125 companies that spin yarns; manufacture fabrics; dye, finish and print fabrics; and cut and sew top-of-the-bed textile products.

The thread count (number of threads per square inch of fabric) is an important indicator of fabric quality for consumers who purchase textile bedding products such as bed sheets. Thread count has evolved over time as a key indicator used by consumers to make purchasing decisions. Generally, it is perceived that the higher the thread count, the better the end product.

The common practice in the U.S. textile bedding industry for decades has been to count the number of threads in both the warp and filling directions. Yarns were counted as one yarn, regardless of whether the yarn was a single ply or multi-ply yarn. (A multi-ply yarn is one yarn that has been created by twisting two or more yarns together.) In recent years, however, some textile bedding suppliers have changed the way they have determined thread count by counting plied yarns individually. This practice inflates the thread count numbers to levels which double or triple (or more) the thread count as determined by the long standing, traditional way. This practice has also created confusion in the marketplace and has caused consumers to compare thread counts that may have been calculated in two dramatically different ways.

NON-PUBLIC

Mr. Donald S. Clark, Secretary
U.S. Federal Trade Commission
May 23, 2005
Page 2

The ASTM, an international standards writing organization, addressed the thread count issue in standard D3775-03a (see Section 9.1.4) which states that ends and picks are counted as single units regardless of whether they are comprised of singles or plied yarns. ASTM committee D13.63 on home furnishings is working on a specific definition of thread count for sheets and similar bedding products that would also treat multi-ply yarns as one yarn, though that process is still in the preliminary stage.

Because of the competitive disadvantage imposed on companies that use the traditional way of not considering yarn plies in the final count, some of our members are contemplating changing over to calculating thread count where each ply within a yarn is counted. We ask the Commission's staff for its opinion on whether such a change would be in violation of 15 U.S.C. Section 45(a)(1) of the Federal Trade Commission Act.

We will be pleased to provide any additional information to the Commission staff as it addresses this issue which affects the many consumers who use thread count information to make purchase decision for textile bedding products.

Sincerely,

E. Linwood Wright

E. Linwood Wright, III
Chairman,
Textile Bedding Committee

EXHIBIT C

UNITED STATES OF AMERICA
FEDERAL TRADE COMMISSION
WASHINGTON, D.C. 20580

Division of Enforcement
Bureau of Consumer Protection

August 2, 2005

Mr. E. Linwood Wright, III
Chairman
Textile Bedding Committee
National Textile Association
6 Beacon Street, Suite 1125
Boston, MA 02108

Dear Mr. Wright:

Thank you for your letter requesting a Commission staff opinion regarding the appropriate way to disclose fabric "thread count" (yarns per square inch) on labels or in advertising for household textile products, such as bed sheets. Please note that this information is not required pursuant to the Textile Fiber Products Identification Act, 15 U.S.C. § 70 *et seq.*, and Commission rules and regulations under the Act, 16 C.F.R. Part 303. It is, however, governed by Section 5 of the FTC Act, which prohibits deceptive acts or practices. 15 U.S.C. § 45.

You state that the thread count is an important indicator of fabric quality for consumers who purchase textile bedding products, and that thread count has evolved over time as a key indicator used by consumers to make purchasing decisions. In addition, you state that it is generally understood that a higher thread count indicates a better product. Your letter describes the specific issue with regard to description of thread count as follows:

> The common practice in the U.S. textile bedding industry for decades has been to count the number of threads in both the warp and filling directions. Yarns were counted as one yarn, regardless of whether the yarn was a single ply or multi-ply yarn. (A multi-ply yarn is one yarn that has been created by twisting two or more yarns together.) In recent years, however, some textile bedding suppliers have changed the way they have determined thread count by counting plied yarns individually. This practice inflates the thread count numbers to levels which double or triple (or more) the thread count as determined by the long standing, traditional way. This practice has also created confusion in the marketplace and has caused consumers to compare thread counts that may have been calculated in two dramatically different ways.

Finally, you state that some of your member companies have experienced competitive disadvantage by using the traditional method of counting threads and are considering switching to the method of multiplying by the number of plies within a yarn, thus achieving a higher thread count. You ask for the staff's opinion as to whether the new method could violate Section 5 of the FTC Act.

Case: 1:17-cv-00754-TSB Doc #: 1-3 Filed: 11/08/17 Page: 3 of 3 PAGEID #: 96

Mr. E. Linwood Wright, III, page 2

You further note that ASTM, an international standards organization, has addressed this issue in its Standard Test Method for Warp End Count and Filling Pick Count of Woven Fabric, Designation: D3775-03a. Section 9.1.4 instructs: "Count individual warp yarns (ends) and filling yarns (picks) as single units regardless of whether they are comprised of single or plied components."

A representation about thread count, like other objective, material claims about a product, must be supported by a "reasonable basis." In determining what constitutes a reasonable basis for claims, we consider what experts in the field believe is appropriate, including whether there are relevant consensus based test procedures, such as an ASTM test procedure, or other widely accepted industry practices that apply to the matter. If so, we give such procedures or practices great weight in determining whether the advertiser has met its substantiation burden.

Based upon the ASTM standard, as well as the information you have provided about standard industry practices with regard to disclosing thread count, we believe that consumers could be deceived or misled by the practice of stating an inflated thread count, achieved by multiplying the actual count by the number of plies within the yarn. A possible non-deceptive way to disclose both the thread count and the yarn ply would be to state, for example: "300 thread count, 2 ply yarn." A representation of "600 thread count" for this same product would likely mislead consumers about the quality of the product being purchased.

I also wish to bring to your attention a 1996 closing letter, placed on the FTC public record, terminating an investigation of possibly deceptive practices in connection with the packaging of down comforters. In that instance, the staff determined that no further Commission action was warranted when the company notified the staff that it was changing its package product description from "finely woven 760 threads per sq. inch" to "finely woven 380 2-ply fabric." A copy of this closing letter is attached.

In accordance with Section 1.3(c) of the Commission's Rules of Practice and Procedure, 16 C.F.R. § 1.3(c), this is a staff opinion only and has not been reviewed or approved by the Commission or by any individual Commissioner, and is given without prejudice to the right of the Commission later to rescind the advice and, where appropriate, to commence an enforcement action. In accordance with Section 1.4 of the Commission's Rules of Practice and Procedure, 16 C.F.R. § 1.4, your request for advice, along with this response, will be placed on the public record.

We appreciate your taking the time to write to us. Please feel free to call Steve Ecklund at 202-326-2841 if you have any further questions.

Sincerely yours,

James Kohm
Associate Director for Enforcement

Enclosure